"TICK PARALYSIS" IN MAN AND ANIMALS.

FURTHER PUBLISHED RECORDS, WITH COMMENTS.

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SINCE the appearance of the papers by Hadwen and myself dealing with the subject of "Tick Paralysis[1]," I have had my attention drawn to two interesting papers. The reference to the first paper, by Borthwick (1905), was found whilst compiling Part II of the *Bibliography of the Ixodoidea,* and secondly, I am indebted to the author, Dr I. U. Temple, of Pendleton, Oregon, for sending me a copy of his valuable contribution. The latter appeared in a journal which will scarcely be accessible to European readers, and I therefore have no hesitation in reprinting the greater part of it below. The following account is condensed from the paper by Borthwick (VII. 1905, pp. 33–35).

"Tick Paralysis" in Sheep in Cape Colony.

Borthwick states that "Tick Paralysis" occurs over a large area of Cape Colony, and that the affection has for many years been recognised by sheep farmers there who unanimously attribute it to the attacks of *Ixodes pilosus.* The disease had prevailed to an unusual degree during the preceding winter on certain specified farms on the Fish River Rand and in Somerset East District. The affection occurs most commonly in May–June on sheep runs in long and bushy veld.

Symptoms. At first the affected sheep, whilst grazing, are observed to lag behind the rest of the flock; they lie down, but rise and walk after the flock when approached. After a short time the animals no longer rise on being approached; if they are lifted up they walk unsteadily and soon lie down again. The sheep may be completely paralyzed within six hours after the onset of symptoms, and they appear as if asleep for 24–48 hours; recovery follows rapidly in most cases. Very few animals die if they are left undisturbed in a shed, but deaths are fairly common in the open, for the prostrate sheep fall victims to marauding jackals. The affected sheep show no febrile reaction.

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[1] See Hadwen (x. 1913). *Parasitology*, VI, 283—297; Hadwen and Nuttall. *Ibid.*, 299—301, where references to earlier authors will be found on p. 297.

Autopsy. No noticeable lesions were observed.

Inoculation experiments gave negative results. Veterinary Surgeon Spreull failed twice to transmit the affection from paralysis sheep to healthy sheep by blood inoculation.

Ticks and their bearing on the affection. The ticks, *Ixodes pilosus*, were found both on healthy and affected animals. "The number of ticks does not seem to influence the severity of the case, two ticks inducing as bad a case as fifteen; but if the ticks are removed immediately the sheep is observed to be sick, the recovery is more rapid, within 12 hours, in many cases, recovery is complete."

I. pilosus attaches itself to the host mainly inside the thighs, behind the elbows and between the lower jaws.

Effect of Dipping. The use of Cooper's Dip was found to be effective. Of 88 sheep grazed in a kloof where the disease prevailed, 68 were dipped and 20 were not dipped. During three weeks no cases of tick paralysis occurred among the 68 dipped animals, whilst 6 cases (3 fatal) occurred among the 20 undipped sheep. Moreover, at Hartmanskraal, in the month of June, where 60–70 cases occurred, the trouble ceased on two occasions when dipping was resorted to.

Tick Paralysis in Man in Oregon.

The following extract is from the interesting paper by Temple (IX. 1912, pp. 508–514) with but slight alterations in the numbering of the cases consecutively, typographical corrections and a word or two added in [ ] brackets. Dr Temple writes:—

"The following cases have come under my observation while practising in Wallowa and Umatilla counties, Oregon:

Case 1. Little girl, Thompson, of Wallowa, Oregon. Age five, retired at bed-time in her usual normal health; all her life she had been in perfect health. Upon rising the following morning she was unable to stand on her feet; in attempting to stand she would fall in a heap on the floor. She had perfect control of her upper limbs, temperature normal, absence of pain. The child would have been considered well had it not been for the impediment in standing. I thought, however, the symptoms indicated a serious lesion. She was given calomel and strychnine.

The next morning I called, to find her completely recovered, much to my surprise. The mother told me she had removed a *tick* from the back of the girl's head. I attached no importance to this, thinking it only a coincidence, and concluded the medicine had done wonders. I had not at this time heard of Tick Bite producing paralysis.

Case 2. Little girl, Aiken, age six, of Paradise, Oregon, was brought to my office, a distance of forty miles, lying upon a cot in a spring waggon. Her symptoms were as follows: upon retiring the previous day she was in her usual normal health. The following morning upon arising she was unable to stand upon her feet, according to the parent's story. Upon arriving at my office I found paralysis extending to the knees; slight temperature, no pain, sensory nerves normal, motor nerves completely paralyzed, reflexes absent. She was placed in bed, given purgatives, Potassium Iodide, etc.

The following day the paralysis had extended to the upper limbs, and before night of the third day to the nerves of the throat (Hypoglossal). Thorax and larynx were involved. Her breathing was laboured, she was unable to swallow liquids, phonation was impossible, and she could make only low, guttural sounds.

At the evening call I directed the nurse to apply tincture of Iodine to the spinal column the entire length, and in doing so she found two *ticks* fully distended with blood over the junction of the spinal column with the occipital bones in the hollow depression. I was called by telephone and examination confirmed the report. I removed them by the application of undiluted creoline. I fully expected the child to die. To my surprise, the following morning she was very much improved. By evening she was able to speak, the paralysis gradually receded, remaining longest in the feet. At the end of one week she was able to return to her home.

Case 3. Little girl, age 10 (name Chauvette), at Enterprise, Oregon. I was consulted over the telephone, and the symptoms described being similar to those in previous cases, I directed the mother to search the child for ticks. She did, but failed to find them. When I was called, I had the child stripped, and noted the following symptoms: the patient was nervous, temperature low, pulse rapid, knee reflexes absent, and the child was unable to stand upon her feet. I told the mother the child had symptoms of Tick Paralysis, and we would again attempt to locate the tick.

A careful search located a single *tick* at the vertex, slightly to one side of the part of her hair. The tick was removed under antiseptic precautions. The child had completely recovered the day following its removal. No other treatment was used.

Case 4. Little girl, aged 4, name Welch, of Ukiah, Umatilla county. At this time I was practising at Pendleton, Oregon. I was called by telephone from a distance of forty miles. The little girl's symptoms were described to me as follows by the father. The child had seemed well the day previous, but at this time she was unable to stand upon her feet; she complained of no pain, seemed well so far as the father could see, except that she had lost control of the lower limbs. I directed the father to return to his home, search the child carefully for ticks, especially upon the head, with instructions to notify me of the results of the search. He returned within two hours and informed me that the *ticks* had been located, two in number, on the back of the child's head. He had removed them according to my instructions with kerosene. The father reported the following day that the child was very much better and a prompt recovery ensued, thus avoiding a forty dollar doctor bill by telephone consultation. No other treatment was used.

Of the four cases herewith reported, three were from Wallowa county and one from Umatilla county. No two from any immediate locality and being separated probably 200 miles, but all in the range of the Blue mountains of Eastern Oregon.

It is also noteworthy that the ticks are usually located in pairs; this being for the purpose of fertilizing the ovum and that the principal location is in the hair of the head.

Case 5. The following report comes from Dr G. W. Gregg, Ashland, Oregon. He says: 'In reference to ticks I have seen but one case of paralysis from tick bite. Have seen at least two others that presented rather severe local infection, but no paralysis. The case in point occurred about twelve years ago, while I was practising at Wallowa, Oregon. I was called about six miles north of Wallowa to see a little girl, age seven, whom the parents had informed me had about three days previously complained of tingling and slight numbness in the fingers of both hands, which soon extended to the toes, then gradually extending up the arms and legs and was gradually accompanied by loss of motion.

The morning I was called the tongue and throat were also affected, the child was unable to talk distinctly and could not swallow. Was rational all the time. On examination, I found paralysis of motion of the arms and legs, sensation present in the limbs, pupils dilated, temperature sub-normal, expression dull and patient inclined to somnolence. I found a big fat *tick* about the size of a large bean attached about two inches posterior to the right ear in the hair. I removed the tick antiseptically and left a few doses of strychnine. In two hours there was improvement in her condition which continued, when in six or seven days the child was completely recovered. (Signed) G. W. Gregg.'

In this case you will observe the initial symptoms were described by her parents as beginning in the hands, then in the feet. I feel confident this is not correct, as reports from the laity are not always dependable. It is my opinion the symptoms began in the feet.

The following interesting reports come from Dr E. C. Kirby, of Elgin, Oregon:

'*Case* 6. Baby K., age 2, July, 1913. *Tick* bite on right shoulder, not found or removed until the patient was nearly dead. Temperature 104°, complete paralysis, protruding tongue, spotted, mottled and reddish condition of entire body, duration three days; death followed.

Case 7. Willie C., age 4, residing near the summit of Blue Mountains, in wood camp; temperature 104°, marked paralysis of tongue and jaw, tongue thick and protruding. Paralysis as a whole complete, reflexes absent.

Patient had been sick about four days before I saw him. Skin mottled, purplish, patient removed to the hospital, became unconscious and died. Location of *tick* on right temple bone.

Case 8. Willie Burger, age 7; first complained for several days of being ill, the walking wobbly, eyes became fixed. When I was called I found *tick* attached to nape of neck; removed by excision; pulse very rapid; patient did not seem alarming; patient grew worse until he could not stand; falling backward when he fell. Put him to bed for three weeks; recovery after six weeks.

Case 9. James M., age 5, taken sick with chill and high fever. I was called in on same day. *Tick* located on right ear. Temperature 104°, no paralysis; tick removed and patient made rapid recovery.

I have had many tick bites among adults that cause ugly indolent ulcers; have also had abscesses from the bites. (Signed) E. C. Kirby.'

I mention this last case to indicate to you the different effects produced by the bite of the tick. I presume there is not a physician who has practised in Eastern Oregon a great length of time who has not had severe ulcers from the infection of the tick bite.

It is my opinion the different effect lies in the fact that there are such a variety of ticks inhabiting the Eastern Oregon region.

The following interesting report comes from Dr E. T. Anderson, now of Weiser, Idaho. I preface this report by saying that Dr Anderson was my successor in practice at Enterprise, Oregon, and of necessity covering the same field from which my first three cases are reported:

'*Case* 10. E. A., Sept. 3rd, 1908; male, age 8; was in normal health the evening before, in the morning was unable to stand upon his feet, progressive motor paralysis, ascending in character, sphincters involved, no pain; temperature 102 $\frac{3}{5}$°, pulse 110, respiration 32, reflexes absent in lower extremity. Examination revealed two *ticks*, one large tick distended with blood overlying one small one [doubtless ♀ and ♂] attached to the nape of the neck, within the hair.

Removal of tick was followed by rapid recovery. No other treatment instituted. Recovery complete in three days. (This was the doctor's own little son. Author.)

Case 11. Bessie B., June 7, 1909, age 13. Reported by telephone. The symptoms of acute ascending paralysis was described. I instructed them to look for *ticks*, the same being found over posterior scalp and removed. The child promptly recovered from the paralysis, but from the seat of attachment a large burrowing abscess formed, very indolent in character. I treated this with irrigation (antiseptic) and painted with silver nitrate solution 10 per cent, with complete recovery. (Doubtless in this case the tick's head [capitulum] was not removed and a severe local infection followed. Author.)

Case 12. Bessie J., May 4, 1910; age 2 years, 3 months. Patient moribund when first seen, dying within the hour thereafter; the evening before apparently in good health. When first seen presented picture of complete motor paralysis, with relaxation of the sphincters, pulse 60, temperature 97°, respiration 46, tongue protruding, phonation absent and unable to swallow, reflexes absent. Death. One single *tick* attached at base of occiput.

Case 13. Willie R., June 15, 1909; male, age 11. Complained of weakness for two days, morning of third day could not stand upon feet; by noon of the same day paralysis had extended to hips and involved the sphincters. By evening hands and arms involved. First seen at 11 p. m., when muscles of throat were also paralyzed, tongue protruding, druling excessive, temperature 99°, pulse 84, respiration 47, pulse soft and weak. Examination revealed one large *tick* distended with blood attached near the crown of the head. Two hours after removal the symptoms of the throat were improved, respiration 32. By morning temperature 98·6°, pulse 74, respiration 20, paralysis in feet and lower limbs, phonation possible with a complete recovery in four days. (Signed) E. T. Anderson, Weiser, Idaho.'

It is apparent that death in case No. 12 was due to the age of the child, with little resistance. Case No. 13 shows all the typical symptoms of the ascending character of the paralysis and describes most clearly the process of invasion and recovery.

I have had considerable correspondence with staff members in the Department of Entomology, Washington, D. C., and from such correspondence and the bulletins sent to me I note there is a great variety of ticks infesting our western slope, and also from this particular region. I have sent three ticks from Eastern Oregon...

The progress of paralysis is apparently quite rapid, being from 3 to 5 days from time of beginning to a complete paralysis and often death. Suffice to say the treatment is the removal of the tick by application of coal oil (petroleum), or creoline, which loosens the hold. The prognosis is favourable if paralysis has not advanced to the stage of affecting the organs of respiration or the heart.

In conclusion, I acknowledge that the reports herewith are not classical in their character, and much of the report is taken from memory, that there is apparently considerable difference in the description and symptoms as given by Drs Gregg, Kirby and myself, but in the main features we are of one opinion, namely:

That there are certain species [of tick] capable of producing complete paralysis, of an ascending character, and also death.

That the motor nervous system is affected and that the sensory nerves are not disturbed.

That it does not produce any changes in the brain or cord as recovery is rapid and complete when the tick or ticks are removed in the early stage of the paralysis and a local irritation seems to be the predominating feature.

That the cases herewith reported are sufficient to warrant investigation by the Department of Entomology, and are worthy of mention in North-west medical literature."

REMARKS UPON THE FOREGOING RECORDS.

(1) *Tick paralysis in Sheep.*

The paper by Mally (1904), cited by Hadwen, and that of Borthwick (1905), here abstracted, attribute a disease called "Tick paralysis" in sheep in Cape Colony to the animals being attacked by *Ixodes pilosus* Koch. Both authors state that farmers in Cape Colony have no doubt whatever as to the bearing of the tick upon the affection; the use of Cooper's dip has served to check the disease in paralysis flocks and to prevent the affection in animals exposed in localities where it prevails. The disease has a seasonal incidence, it is acute in its onset, recovery occurs rapidly in most cases. Fever is absent, and the disease is not communicable by blood inoculation. Recovery is hastened by the removal of the ticks. In animals that have died from the disease no noticeable pathological lesions are observable.

In the absence of further data, these observations which I have thus briefly epitomised, could not be regarded as more than merely suggestive. The important paper by Hadwen (*Parasitology*, VI, 283) has, however, thrown much light upon the subject. He not only observed a practically identical disease in sheep in British Columbia, but he reproduced it experimentally by means of ticks (*Dermacentor venustus* Banks).

(2) *Tick Paralysis in Man.*

That a similar affection appears to occur in other animals in British Columbia has been indicated already by Hadwen (*Parasitology*, VI, 285), and Hadwen and Nuttall (*Ibid.*, p. 298) reproduced the disease in a dog in Cambridge, in July, 1913, the ticks (*D. venustus*) having been collected, 5, VI. 1913, from the human subject in the mountains near Nelson, British Columbia. Hadwen (p. 295) quotes Todd (1912) with regard to cases of tick paralysis occurring in five children and one adult in British Columbia, it being assumed that *D. venustus* was the "tick" concerned; he also cites Eaton (1913) with regard to a case in a child in Australia (tick undetermined); the latter author, moreover, quotes cases which have been reported from that country by Cleland.

Since we have been able to reproduce tick paralysis experimentally there can no longer be any doubt as to the existence of this disease.

The symptoms described in the human subject agree with those observed in experimental cases in the sheep and dog, and the symptoms noted in cases occurring in sheep in the field. The 13 cases recorded by Temple in Oregon are of great interest, and in their symptomatology appear in most of the cases to agree fully with the cases briefly reported by Todd from British Columbia.

It is to be regretted that we have not more precise data as to the species of ticks concerned in the causation of the human cases. Todd and Temple merely refer to "ticks." It is true that Temple sent "three ticks from Eastern Oregon" to F. C. Bishopp and W. D. Hunter for determination, and that they proved to be *Dermacentor albipictus*, *D. venustus* and *Ornithodorus megnini*[1] respectively. The last-mentioned species of tick has probably nothing to do with the case, and it is not stated where and how the other two ticks were collected. It is suggestive, however, in view of the experimental results, previously cited, that *D. venustus* is found in Oregon where Temple's cases occurred.

Having formerly lived for a number of years in the Western United States and collected many ticks from my person on expeditions into the mountains, I may say that it was my custom to take a fine comb with me and to remove the ticks which so frequently attached themselves in the hair at the back of the head and neck. I still have some mounted specimens of *Dermacentor* collected in this manner as long ago as 1879 in California. It was a frequent occurrence after a day's shooting in the brush to remove several ticks with the comb. Too much importance might, therefore, be attached to the finding of a tick or two upon the head in children suffering from supposed tick paralysis, for it is reasonably certain that ticks would be frequently found on normal persons if they were looked for with equal diligence. The cases reported by Todd and by Temple, in which ticks were found attached to the head, might well be explained as due to mere coincidence.

That we are dealing with a definite affection, however, has been rendered certain by the experimental results obtained by Hadwen on sheep and by Hadwen and Nuttall on the dog.

No particular species of tick appears to be concerned in the causation of tick paralysis, since *Dermacentor venustus* in British Columbia (? and Oregon) and *Ixodes pilosus* in South Africa both appear capable of inducing the same affection. It is clear that further investigation is required to elucidate the nature of the disease and to determine what species of ticks are capable of producing it. For the present we only possess clear experimental evidence implicating *Dermacentor venustus.*

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[1] This tick, the well-known "spinose ear tick" of American authors, has not been found before so far to the north as Oregon; it was found in a man's ear, its usual site of attachment to a host.

REFERENCES.

BORTHWICK (VII. 1905). Tick paralysis affecting sheep and lambs. *Veterinary Journ.* London, n.s. XII, 33-34. (Abstract of Report to Chief Veterinary Surgeon, Cape Government.)

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